we have added to it a mechanical interpretation which springs from our emotional, anthropomorphic way of fashioning the world.

We have in this description, as Professor Lipps claims, a psychological fact which has two elements. The form of the column exists, for our perception, as the result of certain mechanical conditions. It not only is, but it becomes, not once, but in every instant anew. We give a mechanical interpretation of the column, not reflectively but immediately, as a matter of direct perception. But the mechanical happening without us is not the only happening involved in this phenomenon. There is also a happening within us to which the outward happening is comparable or analogous. Here, according to the author, is the origin of the notion of all force, of all endeavor in nature, and so in the factors which are at present under consideration the existence of the column as I perceive it appears to me, not by reason of any reflexion, but unconsciously and immediately in the very moment in which I perceive it, not only as conditioned by mechanical causes, but as conditioned by mechanical causes which are *like those underlying my own personal activity*. The column acts as I act when I pull myself together and rise from my seat, or as another human being acts when doing a like thing. I cannot perceive the column without picturing it as invested with the activities which I have experience of in myself.

Now from all this proceeds not the full æsthetic impression made upon me by the Doric column, but certainly a part of that impression. Its rising aloft, its endeavoring, fills me with the same joy as does my own, or as does that of another. I *sympathise* with its behavior, with its method of expressing its intrinsic character and life because I recognise in it a natural joy-giving form of conduct which is my own, and thus the feeling of joyous satisfaction at all spatial forms, and, the author adds, all æsthetic pleasure generally, is a beatifying, pleasure-giving feeling of sympathy.

We are unable for lack of space to follow Professor Lipps into his interesting discussions, many of which are familiar to our readers from former mention. The book abounds in figures, by experimenting with which the reader is lead under the guidance of the author's analysis to a theory of optical illusions and to a theory of the æsthetics of space. The subject is one in which not only the special psychologist is interested, but also the general scientific student, who will have the advantage of being able to make the experiments in question without apparatus or paraphernalia of any kind. The study is one of the widest scope and import, and involves educational elements of considerable significance. *μκρκ.*

EMPFINDEN UND DENKEN. Eine physiologische Untersuchung über die Natur des menschlichen Verstandes. By *Albrecht Rau*. Giessen: Emil Roth. 1896. Pages, 385.

The chief purpose of this volume is to investigate the so-called "law of specific sense-energies" as first enunciated in its simplest form by Albrecht von Haller,

then sharply criticised and seriously modified by Johannes Müller and generally accepted, as thus formulated, by Henle, DuBois-Reymond, Helmholtz, and other authorities in the province of neuro-physiology. This law as stated by Johannes Müller is as follows: "Feeling is not the transmission of a quality or a condition of external bodies to consciousness, but the transmission of a quality or condition of our nerves to consciousness produced by the external world." Thus, he adds by way of illustration, we do not feel the knife which causes us pain, but the condition of our nerves as painful. The mechanical vibration, which according to the undulatory theory produces light, is not in itself a sensation of light, and, even if it could become an object of consciousness, would be the consciousness of a vibration; not until it acts upon the optic nerve as the mediator between the cause and the consciousness is it perceived to be luminous. The vibration of a body is not in itself a tone; the tone begins with the sensation through the quality of the auditory nerve, and the sensory nerve feels the same vibration of the apparently sounding body as a trembling sensation.

Interesting and far-reaching deductions from this theory have been drawn by Jacob Henle, DuBois-Reymond and other representatives of physiological idealism, who maintain that as the operation of our thinking faculty leads us to infer the existence of matter, so the operation of the same faculty may lead us just as logically to infer the existence of spirit; in neither case is our belief based upon direct and positive knowledge. If contact with a knife causes pain, we know that this pain is the expression of our own nerves. Indeed, it is possible, under certain physical conditions, to experience it without any apparent external cause; we then attribute it to some unseen disturbance such as a morbid affection of the tissues or the contact of the air with the nerve of a tooth. In every instance, however, the sensation is purely subjective and the existence of an outward cause is simply an assumption or presupposition. The same is true of colors, tones, scents, and savors, which have no existence outside of ourselves. The number of the properties of matter depends upon the number and acuteness of the senses, the lack of a single one of which is attended with the loss of a corresponding class of properties. Thus color does not exist for the blind nor sound for the deaf, because the nerve-substances, in which vibrations are transformed into color or sound and transmitted to consciousness, are either wanting or wholly inactive. The statement in the Mosaic cosmogony "and there was light" is, as DuBois-Reymond observes, "physiologically false, for there could be no light until there was an organism endowed to some degree with the power of sight. Light began to exist with the development of the first small pigmentary spots, which enabled the infusoria to distinguish it from darkness. It is the substance of the optic and auditory nerves which fills with glowing colors and harmonious sounds the otherwise dark and silent world of ponderable and imponderable matter. This distrust of the testimony of the senses, leading logically to a denial of the existence of the external world, is little more than a revival of the idealism of the eighteenth century, which was already latent

in the philosophical speculations of Descartes and found its fullest and most unequivocal expression in the writings of George Berkeley. The logical consequences of physiological idealism, corresponding to Berkeleianism in metaphysics, have been most clearly drawn and most explicitly stated by DuBois-Reymond's pupil, Prof. J. Rosenthal, who declares that the apparent agreement between our sensations and the external processes, by which they are called forth, is an illusion arising from the use of the same designation for both processes, which have nothing at all in common. Thus the process of a luminous sensation bears no resemblance to the process of vibrations in ether, which produce it, as is evident from the fact that the same vibrations, when they act upon the skin, produce a wholly different sensation, namely, heat. The vibrations of the tuning-fork, for example, will be felt and heard and may also be seen, according as they excite the sensory and auditory and possibly the optic nerves. These vibrations, however, are always the same and have nothing in common with the sensations which they produce. Physical science teaches us that the undulatory motion in ether, which we sometimes call light and sometimes heat, is the same motion. The common division of these physical motions into sound, light, heat, etc., is therefore irrational, because it emphasises as regards these motions an accidental moment, namely, the manner in which they act upon man as a creature endowed with different sensations, but does not apply to magnetic, electric, and other processes, for which a different system of classification is used. "The scientific investigation of the physical processes on one hand," says Rosenthal, "and of the physiological processes of the sensations on the other hand exposes the error, which has taken all the deeper root, because language employs the same words for the different processes and thereby renders it more difficult to distinguish between them."

This theory in its logical consequences as deduced by Rau, discredits the validity of the testimony of our senses and thereby destroys the very foundations on which the natural sciences rest. Thus the knowledge of the mutual relations of bodies, which it is the aim of physics to acquire, depends upon the ability of our senses to receive accurate impressions from the external world and to convey them to the brain where they become objects of consciousness. Suppose, says Rau, that Rosenthal should order an apparatus to aid him in his physiological researches, but should find on trial that it conveyed false impressions and led to incorrect inclusions. Would he continue to use it or would he not rather discard it at once as worthless? Our senses are instruments of investigation, with which nature has endowed us. But what service can they render us if their testimony is untrustworthy? If Rosenthal's idealistic standpoint be tenable, he, as a physiologist, must first get rid of his eyes and ears in order to understand the true nature of light and sound; but instead of doing so, he devises the finest and most complicated instruments for the purpose of increasing his seeing and hearing powers; in other words, he is constantly exercising his inventive skill in adding to the energy and efficiency

of the organs of sense which are constantly deceiving him. His conduct is therefore a complete *reductio ad absurdum* of his theory.

In the second chapter we have a presentation of the views of A. W. Volkmann, Wilhelm Wundt, and other physiologists and physiological psychologists in opposition to Müller's law of specific sense-energies, which is shown to be inconsistent with the facts of biology and the modern theory of descent. Interesting in this connexion are the experiments of Graber, Plateau, and others with worms and reptiles, proving that they distinguish light from darkness by means of the surface of the skin, and Sir John Lubbock's observations of ants and wood-lice, all of which are incompatible with Rosenthal's formulation of Müller's law. The third chapter defines Lotze's attitude to this law and is followed by sections on vitalism and spiritualism, Kant and Lotze, the correct interpretation of Müller's law by G. H. Meyer in conformity with the doctrine of descent, the logical method of natural philosophy, the scientific and speculative significance of conceptions, acoustics with a criticism of Helmholtz's theory of tone-sensations and its influence on other theries, and finally a lucid exposition of the author's philosophy of sensation, in which he maintains that thinking is a secondary function and that the primary source of all knowledge lies in the sensations, of which the understanding is a product. Mind is therefore naturally and gradually developed out of the feelings, and it is the purpose of this concluding chapter to trace this process of evolution in connexion with the growth and co-ordination of the organs of touch, taste, smell, hearing, and seeing in the child from the moment of its birth as observed and described by Meynert, Preyer, and Genzmer. "Thought," says Feuerbach," is nothing but a past sensation, a sensation that no longer exists, an indirect, nullified, negatived sensation. A thing does not become an object of thought until it has vanished from view and from sensation. The question What is lightning? does not arise until the lightning is past." In general, thinking is feeling extended to remote or absent objects; it is feeling what is no longer really felt, or seeing what is no longer actually seen. We see the external movement of the mass with the bodily eye; we see with the mind's eye or think the inner movement of the molecules of which the mass is composed; but it is through the visible massive movement that the invisible molecular movement is revealed to us.

It is impossible in this brief notice to enter into a critical discussion of the questions here involved. Whether our readers may accept or repudiate Rau's conclusions, they can hardly fail to be interested in his thoroughly independent and masterly exposition of the relations between feeling and thinking in the light of recent physiological and biological researches and under the all-pervading influence of the doctrine of evolution. E. P. E.

CONTRIBUTIONS TO THE ANALYSIS OF THE SENSATIONS. By *Dr. Ernst Mach*, formerly Professor of Physics in the University of Prague, now Professor of the History and Theory of Inductive Science in the University of Vienna.